Certain aspects of the invention may find application outside the confines of spot-type automotive disc brakes.

a1 cont

2. Related Art

We have established that spot-type single or multi-disc disc brakes of the kind comprising axially movable discs can provide significant advantages over conventional spot-type automotive disc brakes. These advantages are set out in a series of patent applications which we have filed covering various aspects of the constructional differences between such brakes and conventional automotive disc brakes. --

Rewrite the paragraph beginning at line 22 of page 1 as follows:

a2

-- One aspect of these constructional differences relates to the use of resilient means acting between the one or more brake discs and the rotatable mounting therefor, such resilient means being provided to control certain aspects of the dynamics or movement of the brake discs during use. Reference is made to the disclosure in WO 98/26192 for a representative prior disclosure in this regard, and likewise too WO 98/25804. This latter disclosure concerns a disc brake system in which a plurality of leaf springs mounted on a hub and engaging the brake disc apply radially-directed forces between the disc and the hub. --

Rewrite the paragraph beginning at line 16 of page 2 as follows:

a3

-- Such an approach is consistent with the design principles emerging from the basic structure of the disc brake in which the relatively massive central hub provides a convenient reference base not only structurally for the mounting of the biasing springs, but also a relatively massive heat sink whereby a substantial thermal gradient exists in use between the brake disc with its locally-generated thermal energy and relatively low thermal capacity, whereby thermal factors favor minimizing the numbers of components to be subjected to frequent substantial thermal gradients, particularly components such as springs

a3 which are reliant upon thermally sensitive physical properties such as resilience. --

Rewrite the paragraph bridging pages 2 and 3, beginning at line 28 of page 2 as follows:

-- **SUMMARY OF THE INVENTION AND ADVANTAGES**

a4 However, we have discovered that despite the fact that the obviously apparent factors favor the adoption of the disc-mounting principles (with respect to resilient bias) disclosed in the prior art, there are significant and unexpected compensatory advantages in adopting the reverse approach wherein it is the disc itself which provides a mounting base for the resilient means (for example a series of circumferentially-spaced springs), whereby these can be considered as exerting a resilient bias which is directed from their mounting base on the disc to the rotatable disc-mounting hub, contrary to the teachings of the prior art. --

Cancel lines 7 and 8 of page 3 in their entirety.

Rewrite the paragraph beginning at line 10 of page 3 as follows:

a5 -- In embodiments of the invention there are provided resilient means adapted to be mounted on the axially-slideable brake disc in various ways and in various formats providing individual variations in ease of construction and mounting. --

Rewrite the paragraph beginning at line 15 of page 3 as follows:

-- In one embodiment the individual resilient means straddle (either as a unitary construction or as to individual resilient elements) a series of projecting drive keys a6 constructed to slideably cooperate with a series of complementary keyways formed in the rotatable mounting hub for the brake disc. This arrangement provides simplicity of achieving equi-spaced and likewise-balanced application of the resilient bias, without the need for cap screws or similar (potentially liable to corrosion) mounting means. --

Rewrite the paragraph beginning at line 11 of page 4 as follows:

-- A further practical advantage arising from the mounting of the resilient means on the brake disc or discs relates to the dynamics of the axially slideable mounting of the brake disc or discs with the respect to the drive hub or mounting means therefor. We have discovered that one result of the mounting of the resilient means on the hub itself in prior proposals is that appreciable variations in the spring force arise from disc movement itself and from the adoption of two or more discs mounted in face-to-face relationship on the same hub or mounting. --

Rewrite the paragraph beginning at line 27 of page 5 as follows:

-- In this regard, it is to be noted that the resilient means or springs used in the embodiments in relation to the friction elements for maintaining same in their normal non-tilted attitudes, differ significantly from the springs disclosed in the above-identified WO 98/25804 and WO 98/26192 specifications in which the pad springs are mere anti-rattle springs not adapted to hold the brake pads against tilting movement, but merely to avoid rattling. --

Rewrite the paragraph beginning at line 1 of page 6 as follows:

-- Moreover, in the embodiments of the present invention the springs for the discs and for the pads are balanced in terms of their relative loading applied to the discs and the pads in order to achieve the necessary separation of same when braking is discontinued and yet holding the pads and discs against tilting during use. Thus, the spring forces exerted on the pads or friction elements of the present invention are much stronger than those needed merely to prevent rattling or noise suppression. The spring forces are sufficient to restrain the slideable brake pads or friction elements from moving into contact with the brake discs in an uncontrolled manner. The use of the substantially stronger pad springs in the present embodiments assists in positioning the outer rims of the brake discs in their brake-off position

a9 for reducing residual braking torque. --

Rewrite the paragraph beginning at line 16 of page 6 as follows:

-- **THE DRAWINGS**

These and other features and advantages of the present invention will become more readily appreciated when considered in connection with the following detailed

a10 description and appended drawings, wherein:

Figure 1 shows a diagrammatic representation of the thermal and related mass aspects and dynamic aspects of a spot-type disc brake having resilient means adapted to act between a relatively massive hub and a pair of axially slideable brake discs; --

Rewrite the paragraph beginning at line 4 of page 7 as follows:

-- Figures 6, 7, 8 and 9 show a second embodiment of the invention in views

a11 corresponding somewhat to those of Figures 2 - 5 being a side elevation view of the assembly, a plan view of a leaf spring forming one of two resilient means, a side elevation view of same and an elevation view respectively; --

Rewrite the paragraph beginning at line 12 of page 7 as follows:

-- Figures 10, 11, 12 and 13 show related views of a third embodiment of the

a12 invention, showing the assembly, and three views of a wire-format spring forming resilient means therefor which is adapted to be mounted on the brake disc by cooperation of a wire end formation with a corresponding structure of the disc; --

Rewrite the paragraph beginning at line 11 of page 8 as follows:

-- **DETAILED DESCRIPTION**

a13 In Figure 1 the thermal and related mass aspects, which will be referred to and described more fully below, are indicated by references A - E in which:

A refers to the Thermal Differential;

B refers to the Relatively Massive Hub;

C refers to the Spring Effect;

a13

D refers to the Uniform Control of Dynamics; and

E refers to the Localized Spot-Type Brake Effect. --

Rewrite the paragraph beginning at line 21 of page 8 as follows:

-- As shown in Figure 1 a spot-type automotive disc brake system 10 comprises rotatable brake discs 12,14, a rotatable mounting or hub 15 for the discs 12,14 to permit such rotation and which is adapted to drive the brake discs and to have exerted thereon a braking effect by the brake discs when disc brake 10 is actuated. --

a14

Rewrite the paragraph beginning at line 28 of page 8 as follows:

-- Two pairs of friction elements indicated at 16,18 and 20,22 are adapted to frictionally engage braking surfaces on opposite sides of brake discs 12,14 to effect braking on actuation of actuation means 24 therefor. Brake discs 12,14 are axially slideable in use with respect to mounting hub 15 therefor under the action of friction elements 16,18 and 20,22 and actuation means 24 during braking. --

a15

Rewrite the paragraph beginning at line 1 of page 9 as follows:

-- Resilient device or means 26 is provided at circumferentially-spaced positions around brake discs 12,14 and is adapted to act between the brake discs and mounting therefor at said positions. The mounting of the resilient means 26 with respect to the brake disc 12, and on same, is such that the resilient means slides axially with the disc. --

a16

Rewrite the paragraph beginning at line 8 of page 9 as follows:

-- Also shown in Figure 1 at 28 is an indication of the thermal differential which exists between rotatable mounting or hub 15, which has a relatively massive construction, and the brake discs 12,14 at which actuation means 24 causes a localized spot-

a17

a17 type braking effect. --

Rewrite the paragraph bridging pages 9 and 10, beginning at line 25 of page 9 as follows:

-- Turning now to the embodiments of Figures 2 - 27, these will be described with reference to the general structure shown in Figure 1 in which the rotatable mounting or hub 15 and one of the axially slideable brake discs 12 is shown in each of the seven embodiments as part of an assembly which may comprise one, two or more discs and an associated hub, as shown diagrammatically in Figure 1. It is to be understood that the purely diagrammatic representation shown in Figure 1 is intended to be simply a convenient reference base for the technically competent person, for purposes of description, detailed structures being shown in the remaining figures.

a18 Cont

Rewrite the paragraph beginning at line 3 of page 10 as follows:

-- In the embodiments of Figures 2 - 27, the resilient means which is provided at circumferentially-spaced positions around the brake discs and which is adapted to act between the brake disc 12 and the mounting for the brake disc 12 at those positions itself comprises mounting means for the resilient means (in the form of a spring or springs) which is adapted to mount the resilient means at these circumferentially-spaced positions on the brake disc or discs, so that when the resilient means is so mounted it applies a resilient bias directed from the mounting of the resilient means on the disc to the rotatable mounting or hub on which the disc is mounted. The resilient bias, or force acting between the disc 12 and hub is provided and generated by virtue of the resilience of the resilient means and deformation or bending of the resilient means. As will be understood by the person skilled in the art, deformation or bending of resilient means induces stress, for example torsional stress in the case where the resilient means are twisted, this induced stress in the resilient means

a19

a19 Cont'd

generating forces acting in the opposite direction to the deformation or bending and tending to counter the deformation or bending. --

Rewrite the paragraph beginning at line 7 of page 14 as follows:

a20

-- In the embodiment of Figures 28 - 30 the disc 12 has keys 132 which engage in keyways in the hub 15. The resilient means comprises a strip of spring steel 130. The strip 130 in its uninstalled, unloaded condition is generally linear as shown in Figures 28 - 30. The strip includes a number of apertures 140 within it and at each end 136,138 there are recesses or notches 135. In the installed loaded condition of the strip 130 it is bent and mounted within the disc 12 with the apertures 140 fitting over and straddling the keys 132 of the disc. The end of the strip 130 abut against one 132A of the keys 132 with the notches 135,137 engaging on either side of that key. The three apertures 140 are equally spaced so as to receive the three other keys 132 of disc 12 and the portions of strip 130 therebetween extend in use, in a generally chordal direction relative to the disc inner periphery and provide the resilient effect acting between the disc 12 and the hub 15 (not shown) which is mounted within the disc. It will be appreciated that the outer periphery of hub 15 abuts against the portions 131 of strip 130 between apertures 140. --

Cancel claims 1-10.

Add the following claims:

a21

12. A method of making a disc brake system, comprising:

providing at least one brake disc having braking surfaces on opposite sides of the at least one brake disc;

supporting the at least one brake disc on a rotatable mounting such that the at least one brake disc is rotatable with the rotatable mounting and slideable axially relative to the rotatable mounting;

arranging at least one pair of friction elements on the opposite sides of the at least one brake disc operative when actuated to axially displace the at least one braking disc and frictionally engage the braking surfaces of the at least one brake disc to effect braking action of the at least one disc and the rotatable mounting; and

mounting a resilient device at circumferentially spaced locations on the at least one brake disc slideable axially with the at least one brake disc and exerting a constant resilient bias force between the at least one brake disc and the rotatable mounting.

13. The method of claim 11 wherein the resilient device is provided in the form of a plurality of resilient spring members mounted on and movable with the at least one brake disc.

14. A method of mounting an axially movable brake disc on a rotatable mounting of a disc brake system, comprising: providing a resilient device adapted to act between the brake disc and the rotatable mounting for the brake disc at circumferentially spaced positions around the brake disc, and mounting the resilient device on the brake disc for axial movement with the brake disc and to apply a resilient bias force directed from the brake disc to the rotatable mounting.

15. A disc brake system comprising:

a rotatable mounting;

at least one brake disc supported on said rotatable mounting for relative axial displacement and for rotation therewith, said at least one brake disc having opposite sides and braking surfaces on said opposite sides;

at least one pair of friction elements operative when actuated to frictionally engage said braking surfaces of said at least one brake disc to effect braking action of said at least one brake disc and said rotatable mounting; and

a resilient device mounted at circumferentially spaced locations on said at least one brake disc and movable axially with said at least one brake disc relative to said rotatable mounting, said resilient device acting between said at least one brake disc and said rotatable mounting to apply a resilient bias force directed from said at least one brake disc to said rotatable mounting.

16 15
~~15~~. The brake disc system of claim ~~14~~ wherein said at least one brake disc includes drive keys engaging associated drive keyways of said rotatable mounting, said resilient device straddling said drive keys of said at least one brake disc.

17 15
~~16~~. The disc brake system of claim ~~14~~ wherein said resilient device comprises at least one leaf spring having resilient flanges engaging said at least one brake disc.

18 15
~~17~~. The disc brake system of claim ~~14~~ wherein said spring device comprises at least one spring disposed under stress between said at least one brake disc and said rotatable mounting to exert said resilient bias force therebetween.

19
~~18~~. A disc brake system comprising: an axially movable brake disc supported on a rotatable mounting; a resilient device adapted to act between said brake disc and said rotatable mounting at circumferentially spaced positions around said brake disc, said resilient device being mounted on said brake disc for axial movement with said brake disc and to apply a resilient bias force directed from said brake disc to said rotatable mounting.

20 19
~~19~~. The brake disc system of claim ~~18~~ wherein said brake disc includes drive keys engaging associated drive keyways of said rotatable mounting, said resilient device straddling said drive keys of said brake disc.

21 19
~~20~~. The disc brake system of claim ~~18~~ wherein said resilient device comprises at least one leaf spring having resilient flanges engaging said brake disc.

~~21.~~ 22 The disc brake system of claim ~~18~~ 19 wherein said spring device comprises at least one spring disposed under stress between said brake disc and said rotatable mounting to exert said resilient bias force therebetween.